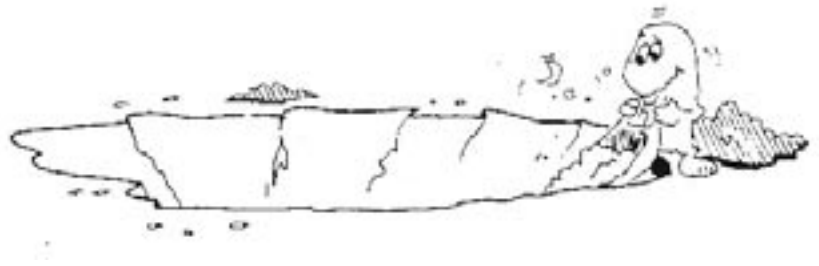


UNIT 3: LANDFILL



VOCABULARY

Aquifer
Decompose
Groundwater
Landfill cell
Methane gas
Tip

Compaction
Disposal
Landfill
Leachate
Rubbish dump
Waste

BACKGROUND

The average New Zealander produces 2.5 kg of waste per day. LANDFILLING is the primary method of disposal for solid waste in New Zealand. While this country does not have a high population, landfill sites are increasingly difficult to secure. Public opposition to landfills and constraints on suitable land are among the factors that contribute to this difficulty. The Resource Management Act (1991) set up strict regulations on the evaluation of landfill monitoring and aftercare, making landfilling an expensive and non-sustainable option for managing our waste.

Landfills have existed since the 1930's. Early landfills were only open pit dumps covered with dirt regularly to hide rubbish and cut down on pests and smells. Modern landfills are lined on the bottom with dense clay, limestone or soil. Landfills have been sited in old quarries, mines, canyons and even former wetlands.

Each day rubbish is taken to landfills and dumped. Once in the landfill, rubbish is compacted into cells and covered with a layer of clay. Topsoil is then added as a final covering so plants can grow and prevent erosion.

As some waste slowly decomposes, it creates methane and sulphurous gases. These gases can pose a serious fire or explosive danger. They also contribute to global warming. The environmental impact of these gases is carefully managed by underground extraction systems. Gases are either burned off safely or used to generate power.

Another result of the breakdown process is a liquid substance called leachate. Leachate is formed when water (either from rain or underground waterways) combines with decomposing rubbish. Leachate is drained off into nearby water treatment systems.

Incineration is another method of waste disposal. Incinerators are basically large furnaces that burn rubbish to reduce its volume and/or to produce energy. Incineration only reduces waste by about 70%. The remaining 30% ends up in landfills as toxic ash. Currently there are no incinerators operating in New Zealand that burn household waste.

LANDFILL

Materials students may bring from home

paper
crayons
pens
2 kg pre-sorted clean rubbish

2 samples of each:
food scraps
newspaper
glass
cloth
aluminium foil
plastic

1 cardboard box or small fish aquarium

plastic bags
earth (not potting soil)
masking tape
small cardboard squares
water
magnifying glass

4 ltr metal can
fine metal screen
cardboard box
masking tape
paper
eggshells
orange peel
food scraps
serviettes
matches
ruler



A LANDFILL...

One Place Our Rubbish Goes



KEY CONCEPT

We use landfills to dispose of our waste.

By producing less waste and recycling we conserve landfill space.

LEARNING OBJECTIVES

Students will learn what a landfill looks like, what happens there, reasons why they exist and why methods, such as waste reduction, recycling and reuse, are needed to divert waste from landfills.

MATERIALS

- Paper
- Crayons, pens
- 2 kg bag of pre-sorted rubbish
- Worksheet 12, "Diagram of a Landfill"

BACKGROUND INFORMATION

LANDFILLS

New Zealanders produce an estimated 2.5kg of waste per day. Landfilling is the primary method of handling this waste.

As little as 30 years ago landfills were dug wherever cheap unwanted land was available, in old quarries, abandoned mines, gravel pits, and marshlands. Modern waste disposal facilities are known as sanitary landfills. A sanitary landfill is a designated piece of land where rubbish is tipped, compacted and covered daily. Clay, soil or sawdust is often used to cover rubbish. This cover reduces smell, vermin and litter, and controls incoming water. As rainwater falls onto the tip face, it breaks up waste products. The resulting residue material, known as leachate, trickles down to the

bottom of the landfill where it is collected and pumped out for treatment.

As waste slowly decomposes under layers of dirt and clay, it emits methane gases. These gases are carefully monitored and extracted from the landfill. In larger landfill sites the methane gas collected is converted to energy. At the Greenmount and Rosedale Road landfill sites in Auckland, methane gas is extracted and converted to electricity.

Landfills in New Zealand are filling up quickly. The process of siting a new landfill is long and difficult. Public opinion of landfills affects this process. Few people want to have a landfill in their community. This is commonly referred to as the NIMBY or "Not In My Backyard" syndrome.

Incineration is another waste disposal method. A number of incinerators are located in Europe, Asia, and the USA. Currently, a handful of incinerators are used in New Zealand for quarantine and hospital wastes. In an incinerator rubbish is burned in a furnace and reduced to ash.

Incinerators reduce waste volumes, but the residual ash still needs to be disposed of. Burning waste can cause air pollution. Modern pollution control devices can help to minimise this.

TRANSFER STATIONS

Transfer stations are not a disposal facility in themselves, but rather a facility to assist in the disposal of refuse. Refuse is brought to the station and transferred to bulk haulage vehicles, which take it to the disposal facility. It also reduces the pressure on access roadways.



LEARNING STEPS

1. Photocopy/draw diagram of a landfill. Explain how a landfill works (refer in the past tips/dumps.)
2. Review the introduction and background information on landfills. What sort of problems would a landfill cause?
3. Would you like to have a landfill near you? Where is your nearest landfill?
4. What are the positive/negative effects of landfills such as space, dust, pests, leachate, etc.?
5. What are the differences between landfills and transfer station? What are the benefits of each? What are the disadvantages?
6. Bring a 2.5 kg bag of pre-sorted rubbish to class or bring in a school rubbish bin. Based on the figure of 2.5 kg per day, calculate how much rubbish the class produce as individuals and as a class each day, each week, each year.
7. Where does all this rubbish go? What happens when landfills fill up? What can you and I do to help solve this problem of too much rubbish?



EXTRA ACTIVITIES

1. Other Ways to Handle Waste

Brainstorm alternatives to landfilling or incinerating waste. Discuss waste reduction, recycling, reuse and composting as safer, more efficient methods of handling our waste. Emphasise that waste reduction is the best method for handling waste as it reduces it before it is actually a disposal problem.

2. How Does it Work?

Students make a poster or brochure about what happens to our waste and what can be done to reduce, reuse and recycle. Display the poster or brochure where other students and teachers may view it.

3. Transfer Station and Recycling Depot Trip

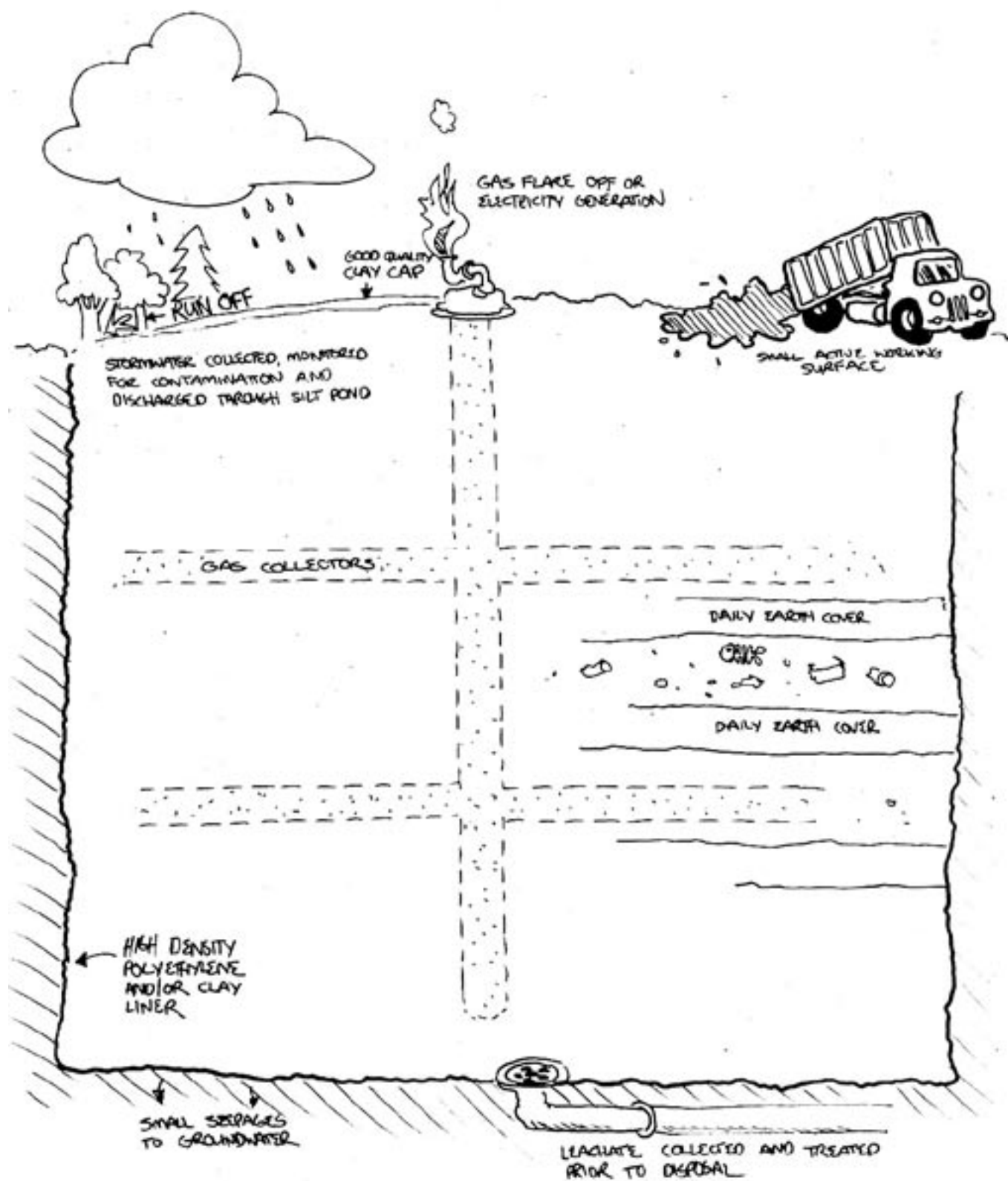
Visit a local transfer station. Ring the Auckland Regional Council Enviroline (09) 366-2070 for more information.

4. Dig a Rubbish Graveyard

Try an experiment in your lawn. Bury some food scraps side-by-side with other materials such as paper, plastic and aluminium. Mark the materials with yoghurt cups, pieces of plastic etc. Dig them up a month later. Which materials are beginning to decompose and rot? Which aren't? Graph the results.

WORKSHEET 12

Landfill



BUILD YOUR OWN LANDFILL



KEY CONCEPT

Some materials decompose faster than others in a landfill.

LEARNING OBJECTIVES

In making their own landfills, students will understand how a landfill works.

LEARNING STEPS

Ask: "What kind of materials will break down into their natural elements (biodegradable) in a landfill?"

"What kind of materials will not?"

MATERIALS

- 2 identical samples of: food scraps, newspaper, glass, cloth, aluminium foil, plastic
- 1 cardboard shoebox or small fish aquarium
- Plastic bags to line the box or tank
- Earth (not potting soil)
- Masking tape
- Index cards or small cardboard squares
- Water
- Magnifying glass
- Worksheet 13, "My Own Landfill"

1. What is the purpose of a landfill and how they are constructed. Note that landfills not only hold waste, but that the process of covering rubbish with soil actually helps break it down into smaller pieces and simpler components, prevents disease, detracts rate, etc.
2. Individually or in small groups construct a mini-landfill. Line a shoebox or aquarium with a plastic bag and half fill it full of earth. (Note: do not use potting soil as it has been sterilised and does not contain the microorganisms, which are essential to the decomposition process.)
3. Bury two identical rows of rubbish (see list of materials), marking the location of each with a cardboard label.
4. Use Worksheet 13 for each landfill project to monitor the experiment. Note the items placed in the landfill, along with the date, Add water to moisten the soil and place the mini-landfill in a sunny spot. The landfills should be watered regularly (simulate rain) Keep the soil moist but not wet.
5. After 7-10 days, carefully remove the waste items from one row of the landfill and examine them. (A magnifying glass may be helpful at this point.) Complete the questions for Week One on Worksheet 13.

BACKGROUND INFORMATION

Sanitary landfilling can be defined as a method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilising the principles of engineering to confine the refuse to the smallest practical volume, and to cover it with a layer of earth or some other material at the conclusion of each day's operation or at more frequent intervals. Large machines called traxcavators run over the refuse to flatten and compact it.

6. Wait another two weeks and repeat the procedure for the second row of buried materials. Complete the questions for week three on the worksheet.
7. What were the results? Which items in the landfill decomposed the most? Were the decomposed items natural or man-made? What characteristics are shared by the items that decomposed the quickest?

Some items will show no signs of decomposition: Will they remain unchanged for a long time and why? If the landfill has been made of sterilised soil, would the waste have decomposed as quickly?

EXTRA ACTIVITIES

1. Site a Landfill

Conduct a mock landfill siting hearing. Each student takes a role as a householder, town planner, solicitor, local council member, recycler, waste collector, environmentalist, etc. The aim of the meeting is to site a new landfill in your community. Where is a safe place to have a landfill? Is there room? What would the environmental effects be on wildlife? people? What sort of permits are required to operate a landfill? Who will look after the site? What alternatives are there to landfills? Should a recycling centre be opened near the landfill?

Record the minutes from the meeting. Discuss what the students learned from the process.



WORKSHEET 13

My Own Landfill

1. List the items placed in the landfill and the date you buried them:

2. The items placed which decomposed the most were:

Week 1:

Week 3:

3. The items that only decomposed a little were:

Week 1:

Week 3:

4. The items that did not change at all:

Week 1:

Week 3:

5. Why do you think some items decomposed more rapidly than others?

6. Were there any significant changes you noticed between Week 1 and Week 3?

7. Graph the results of your study on a bar graph.

8. What does this study tell you about the types of items we put in landfills?

9. Are there items that should never go into landfills?